

AMENDMENTS TO THE CLAIMS

Please replace all prior versions, and listings, of claims in the application with the following list of claims:

1. (Currently amended) A method of processing at least first and second images of an image flow of an object to determine a relative displacement map of elements of the image flow over a predetermined time interval, the method comprising:

- (a) recording a first array of pixel values associated with the first image of the image flow;
- (b) recording a second array of pixel values associated with the second image of the image flow;
- (c) defining a first plurality of interrogation regions on ~~each of the first and second arrays~~ array of pixel values, and each of the first plurality of interrogation regions including a first number of pixels indicative of a first resolution at which to correlate the first and second images ~~minimal pixel resolution;~~
- (d) ~~processing a first interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values to provide~~ determining a first correlation plane formed from correlations between each of the first plurality of interrogation regions and at least one associated region in the second array of pixel values, the first correlation plane including a maximum correlation value for each of the first plurality of interrogation regions indicating which of the at least one associated regions each of the first plurality of interrogation regions are most highly correlated with ~~including a first plurality of signal values;~~
- (e) ~~detecting a first predetermined signal value from the first plurality of signal values associated with the first correlation plane; and~~
- (f) determining a direction and magnitude associated with each of the maximum correlation values of the first predetermined signal value located on the first correlation plane which represents the relative displacement of elements of the image flow between each of the first interrogation regions and the respective most highly correlated associated region in the second array of pixels over the predetermined time interval;

for each of the determined directions and magnitudes that are resolved, adding each resolved direction and magnitude to the displacement map at a location associated with the respective first interrogation region;

for each of the determined directions and magnitudes that are unresolved, expanding the associated first interrogation region to form a second plurality of interrogation regions, each of the second plurality of interrogation regions having a second number of pixels, greater than the first number of pixels, indicative of a second resolution at which to correlate the first and second images and determining a second correlation plane formed from correlations between each of the second plurality of interrogation regions and one or more associated regions in the second array of pixel values, the second correlation plane including a maximum correlation value for each of the second plurality of interrogation regions indicating which of the at least one associated regions each of the second plurality of interrogation regions are most highly correlated with, and determining a direction and magnitude associated with each of the maximum correlation values which represents the relative displacement between each of the second interrogation regions and the respective most highly correlated associated region in the second array of pixels over the predetermined time interval; and

for each of the determined directions and magnitudes that are resolved, adding each resolved direction and magnitude to the displacement map at a location associated with the respective second interrogation region.

2-5. (Canceled).

6. (Currently amended) The method of claim 5, wherein for each of the determined directions and magnitudes that are unresolved, the method further includes:

expanding the associated second interrogation region to form a third plurality of interrogation regions, each of the third plurality of interrogation regions having a third number of pixels, greater than the second number of pixels, indicative of a third resolution at which to correlate the first and second images ~~if the direction and magnitude of the second predetermined signal value is unresolved, the method further includes:~~

~~(k) grouping predetermined ones of the second plurality of interrogation regions located on each of the first and second arrays of pixel values of the image flow to form a third plurality of interrogation regions on each of the first and second arrays of pixel values of the image flow and each of the third plurality of interrogation regions including a third minimal pixel resolution greater than the second minimal pixel resolution.~~

7. (Currently amended) The method of claim 6, further including:

~~(1) processing a third interrogation region from each of the third plurality of interrogation regions located on each of the first and second arrays of pixel values to provide~~ determining a third correlation plane formed from correlations between each of the third plurality of interrogation regions and one or more associated regions in the second array of pixel values, the third correlation plane including a maximum correlation value for each of the third plurality of interrogation regions indicating which of the at least one associated regions each of the third plurality of interrogation regions are most highly correlated with ~~including a third plurality of signal values.~~

8. (Canceled).

9. (Currently amended) The method of claim 7[[8]], further including:

~~(n) determining a direction and magnitude associated with each of the maximum correlation values of the third predetermined signal value located on the third correlation plane which represents the relative displacement of elements of the image flow between each of the third~~ interrogation regions and the respective most highly correlated associated region in the second array of pixels over the predetermined time interval.

10. (Currently amended) The method of claim 1, wherein expanding the plurality of interrogations regions includes doubling the number of pixels that form each of the plurality of interrogation regions ~~processing further includes:~~

~~interacting the first interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values with a discrete correlation function to provide the first correlation plane including the first plurality of signal values.~~

11. (Currently amended) The method of claim 3, wherein ~~processing further includes:~~
~~processing at least one other interrogation region from each of the first plurality of~~
~~interrogation regions located on each of the first and second arrays of pixel values to provide at least~~
~~one other correlation plane including a plurality of signal values; and~~
~~combining~~ determining the first second correlation plane and the at least one other correlation
plane to provide the second correlation plane includes combining corresponding portions of the first
correlation plane.

12. (Currently amended) The method of claim 7, wherein ~~processing further includes:~~
~~processing at least one other interrogation region from each of the first plurality of~~
~~interrogation regions located on each of the first and second arrays of pixel values to provide at least~~
~~one other correlation plane including a plurality of signal values; and~~
~~combining~~ determining the second third correlation plane and the at least one other correlation
plane to provide the third correlation plane includes combining corresponding portions of the second
correlation plane.

13-15. (Canceled)

16. (Currently amended) The method of claim 1[[2]], wherein expanding the associated first
interrogation regions ~~grouping further~~ includes grouping at least two interrogation regions of the first
plurality of interrogation regions to form one of the second plurality of interrogation regions ~~of each~~
~~of the first and second arrays of pixel values to form each interrogation region of the second plurality~~
~~of interrogation regions respectively located on each of the first and second arrays of pixel values.~~

17. (Currently amended) The method according to claim 6, wherein expanding the associated first interrogation regions ~~grouping further~~ includes grouping at least two interrogation regions of the second plurality of interrogation regions to form one of the third plurality of interrogation regions ~~of each of the first and second arrays of pixel values to form each interrogation region of the third plurality of interrogation regions respectively located on each of the first and second arrays of pixel values.~~

18-21. (Canceled)

22. (New) A method of processing a first image and a second image of a scene obtained at a first time and a second time, respectively, to determine relative displacement of elements in the images between the first time and the second time, the method comprising:

grouping pixels in the first image into a first interrogation region consisting of a first number of pixels indicative of a first desired scale at which to correlate the first image and the second image;

correlating the first interrogation region with a first plurality of associated regions in the second image to obtain a respective first plurality of correlation values;

if a maximum correlation value of the first plurality of correlation values exceeds a threshold value, determining a displacement associated with the maximum correlation value indicative of the displacement between the first interrogation region and the associated region that resulted in the maximum correlation value; and

if the maximum correlation value does not exceed the threshold value, expanding the first interrogation region to include additional pixels such that the first interrogation region consists of a second number of pixels indicative of a second desired scale at which to correlate the first image and the second image, and correlating the expanded first interrogation region with a second plurality of associated regions in the second image to obtain a respective second plurality of correlation values.

23. (New) The method of claim 22, further comprising:

if a second maximum correlation value of the second plurality of correlation values exceeds the threshold, determining a displacement value associated with the maximum correlation value; and

if the second maximum correlation value does not exceed the threshold value, expanding the first interrogation region to include additional pixels such that the first interrogation region consists of a third number of pixels indicative of a third desired scale, and correlating the expanded first interrogation region with a third plurality of associated regions in the second image to obtain a respective third plurality of correlation values.

24. (New) The method of claim 23, wherein the first interrogation region is repeatedly expanded until a resulting maximum correlation value of a resulting plurality of correlation values exceeds the threshold value.

25. (New) The method of claim 24, wherein expanding the first interrogation region is performed according to one or more features in the first image.

26. (New) The method of claim 25, further comprising identifying at least one object boundary in the first image, and wherein the first interrogation region is expanded to include only pixels within the at least one object boundary.

27. (New) The method of claim 22, wherein grouping pixels includes grouping pixels in the first image into a plurality of interrogation regions, each having a number of pixels reflective of a first scale, and wherein correlating includes correlating each of the plurality of interrogation regions with a respective plurality of associated regions in the second image to obtain a plurality of correlation values for each of the plurality of interrogation regions.

28. (New) The method of claim 27, further comprising identifying a maximum correlation value of the plurality of correlation values for each of the plurality of interrogation regions to form a plurality of maximum correlation values.

29. (New) The method of claim 28, further comprising expanding each of the plurality of interrogation regions for which an associated one of the plurality of maximum correlation values is less than the threshold value, wherein expanding includes adding additional pixels to the respective interrogation region such that each resulting interrogation region includes a second number of pixels reflective of a second scale.

30. (New) The method of claim 29, wherein expanding includes combining at least some of the plurality of interrogation regions that are adjacent one another into respective larger interrogation regions, and wherein the plurality of correlation values for each of the respective interrogation regions that were combined are added to obtain an updated plurality of correlation values.

31. (New) The method of claim 30, further comprising identifying an updated maximum correlation value for each of the updated plurality of correlation values of each respective larger interrogation region to form a plurality of updated maximum correlation values, and wherein for each of the plurality of updated maximum correlation values that do not exceed the threshold, expanding the interrogation region by adding additional pixels to the respective interrogation region such that each resulting interrogation region includes a number of pixels reflective of a third scale at which to correlate the first image and the second image.

32. (New) The method of claim 31, wherein combining at least some of the plurality of adjacent interrogation regions having associated updated maximum correlation values that do not exceed the threshold hold is repeated at higher scales until the updated maximum correlation value associated with a particular combined interrogation region exceeds the threshold.

33. (New) The method of claim 32, wherein a displacement value is determined for each interrogation region resulting in a maximum correlation value that exceeds the threshold value, the displacement value being indicative of the vector difference between a location of the interrogation

region in the first image and a location of the associated region in the second image from which the maximum correlation value resulted.

34. (New) The method of claim 33, wherein each computed displacement value forms a displacement map indicative of the displacement of elements during the first time and the second time.